Arizona Trauma System: Patient Profile

2007

Trauma System Annual Report

Data Sources

Arizona State Trauma Registry, 2005

Arizona Hospital Discharge Database, 2005

Arizona Department of Health Services
Bureau of Emergency Medical Services and Trauma System

Arizona Trauma System

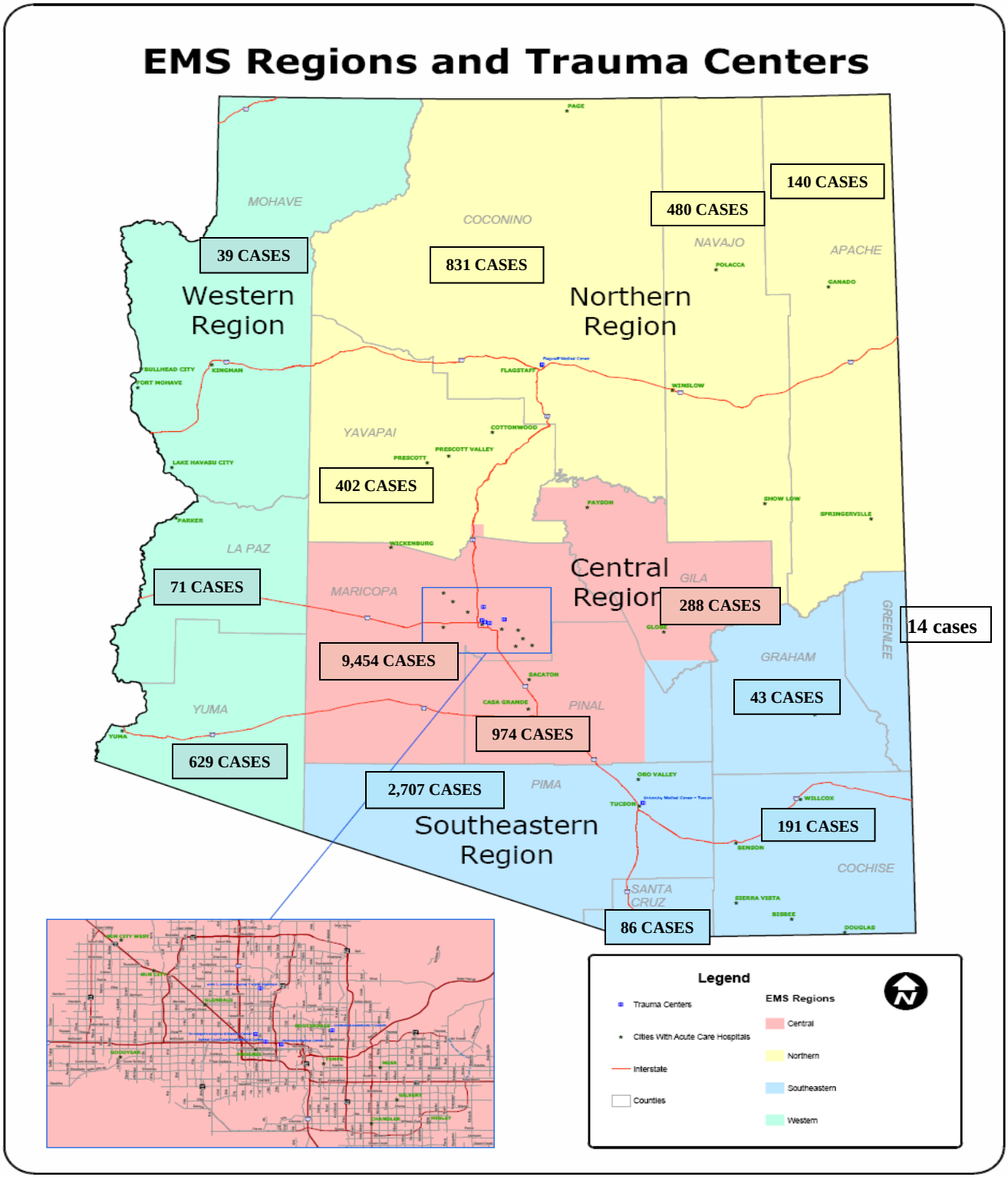
Annual report

2007

Prepared by:

Vatsal Chikani, M.P.H., B.H.M.S. Biostatistician
Georgia Yee, BSW, CTR, Office Chief, Health Registries
Anita Ray, B.A., Trauma Registry Manager

Figure 1: Trauma System Patient by County of Injury 2005



TRAUMA CASE COUNT LEGEND	
In-State Cases	16,349
Other (Out-of-State)	440
Missing County	5,471
Total Cases	22,260

Executive Summary

- In 2005, total charges in Arizona due to trauma related cases were more than $917 million.
- The highest charges were due to motor vehicle crashes (> $243 million) followed by falls (> $177 million).
- Almost a quarter of the trauma patients had AHCCCS/Medicaid as the primary payer, accounting for more than $279 million total charges.
- In 2005, a total of 22,260 trauma patients were admitted to trauma centers in the state of Arizona.
- Pediatric patients (aged 0-19 years) accounted for 25.0% of cases, while geriatric patients (aged 55 years and older) accounted for 13.4% of cases.
- Males accounted for the majority of trauma patients (66.9%).
- The majority of trauma patients (84.3%) suffered blunt trauma; 11.1% suffered penetrating trauma.
- Overall, motor vehicle crashes were the single greatest mechanism of injury (64.7%) with falls second (10.6%). However, for ages 15-19, firearms were the second leading cause of injury (8.0%).
- In 2005, 813 (3.8%) patients died of traumatic injury in the state of Arizona. The pediatric population had a fatality rate of 2.4% and the elderly population had a highest fatality rate of 7.5%.
- Motor vehicle crashes accounted for the greatest number of deaths (58.8%), with firearms second (20.8%).
- In motor vehicle crashes, 35.4% of patients were reported as using no restraint device when the motor vehicle they were driving or riding in crashed.
- In motorcycle crashes, 48.0% of the motorcyclists were reported as wearing no helmet; and 50.7% of the bicyclists were reported as wearing no helmet.
- Among pediatric patients, 46.7% of trauma patients were reported as using no restraint device (seatbelt or car seat). Of the geriatric trauma patients, 20.9% were reported as using no restraint device (seatbelt) when the motor vehicle they were driving or riding in crashed.
- Overall, 14.1% of the trauma patients tested positive for a blood alcohol level of ≥ 0.08 gm/100cc and 17.1% tested positive on the drug screen test.
- Just over 10% of pediatric patients (age 15 to 19 years) and 6.2% of geriatric patients tested positive for a blood alcohol level of ≥ 0.08 gm/100cc.
- Of the 15-19 pediatric age group, 19.0% tested positive on the drug screen test and 8.6% of geriatric patients also tested positive.
- The most lethal mechanism of injury associated with a positive alcohol test was firearm related injuries (9.9% mortality), followed by pedestrian struck by a motor vehicle (9.7%).
- Most of the trauma patients receiving care at the reporting hospitals had an Injury Severity Score (ISS) between 1 to 4 (46.7%), while 17% of the patients had severe injuries with an ISS > 15.

Data source: Arizona Hospital Discharge Database, 2005
Arizona State Trauma Registry, 2005

Total charges Related to Trauma in the State of Arizona 2005

Arizona Hospital Discharge Database for the year 2005 was queried to identify all patients whose primary discharge diagnosis fell within the ICD-9 code ranges 800 through 959.9, amounting to 23,314 trauma cases. (Codes involving isolated femoral neck (hip) and distal extremity fracture from a same-level fall and non-acute injury related diagnoses were excluded from this analysis).

Total Charges by Mechanism of Injury

In 2005, total charges in Arizona due to trauma related cases were more than $917 million (Table 1). The highest total charges were due to motor vehicle crashes (more than $243 million) followed by falls (more than $177 million). The average total charge was highest for a firearm injury ($70,929).

("Total Charges" means the whole dollar amount for services provided during an episode of care. This amount does not reflect the cost of providing the services, nor the specific payment that the hospital actually received for that episode of care.)

Table 1: Total Charges by Mechanism of Injury

Mechanism of Injury	Total Charges
Cut/Pierce	$31,592,664
Fall	$177,819,403
Firearm	$65,112,520
MV Occupant	$243,839,271
MV Motorcyclist	$59,322,079
MV Pedalcyclist	$12,496,878
MV Pedestrian	$48,235,849
MV Other	$50,799,952
Transport, Other	$14,006,315
Struck by, Against	$38,827,978
Other	$175,323,470
Total charges	$917,376,379

Total Charges by Age Groups

Total charges due to trauma were highest for patients aged 25-44 years (more than $283 million) followed by patients aged 45-64 years (more than $206 million) (Table 2). The average charge was highest for a 38 year old patient (($59,963).

Table 2: Total Charges by Age

Age Groups	Total Charges
< 1	$4,771,408
1-4	$15,567,001
5-9	$16,694,330
10-14	$22,656,153
15-19	$89,226,289
20-24	$99,698,233
25-44	$283,093,690
45-64	$206,035,773
65-74	$62,491,950
75-84	$74,419,641
85+	$42,370,825
Missing Age	$351,086
Total	$917,376,379

Primary Payer Mix

Almost a quarter of the trauma patients had AHCCCS/Medicaid as the primary payer, accounting for more than $279 million total charges (Table 3).
("Payer" means the expected source of payment for the majority of the charges billed for the episode of the care).

Table 3: Primary Payer Mix

Primary Payer	Total Charges
Self pay	$82,134,071
Private Insurance	$240,996,065
Medicare	$187,068,083
AHCCCS/Medicaid	$279,061,928
Worker's Compensation	$46,286,655
Other	$81,829,577

Trauma System Profile 2005

Ten hospitals contributed 2005 trauma data to the Arizona State Trauma Registry (ASTR). Of the ten hospitals that contributed data, seven are designated as Level I Trauma Centers and three hospitals are non-designated. Two of the non-designated facilities submitted only partial data for 2005. As ASTR receives data from a limited number of hospitals in Arizona, the records in this report are not representative of all Arizona trauma cases statewide.

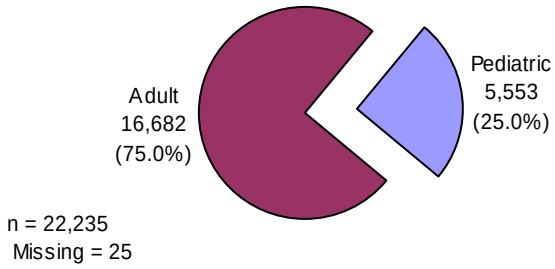
During Phase I and Phase II of the Data Standardization Project, the state required data elements from hospital registries were converted to a standardized format. In 2005, not all reporting facilities were collecting every data element in this report. The quality of the data has not been assessed and data entry errors are known to be present.

This report summarizes data compiled from the ASTR for the 2005 year. It is important to note that data and rates in this report are subject to change as data are quality controlled. This report reflects trauma data as it existed in the ASTR database on 5/1/07. There were 22,260 records submitted to ASTR with emergency department and admit arrival dates from 1/1/05 to 12/31/05.

Trauma Volume

Figure 2 demonstrates the volume of adult and pediatric trauma patients in the state of Arizona. Pediatric patients are defined as ages 0-19 years. Among the pediatric patients, 2,360 (42.5%) cases were younger than 15 years and 3,193 (57.5%) cases were 15-19 years old. There were 152 (0.7%) patients aged 1 year or less when they entered the trauma system. Among the adult patients, 34.6% of the patients were 25-44 years old and 13.4% of patients were geriatric trauma patients (ages 55 years and older).

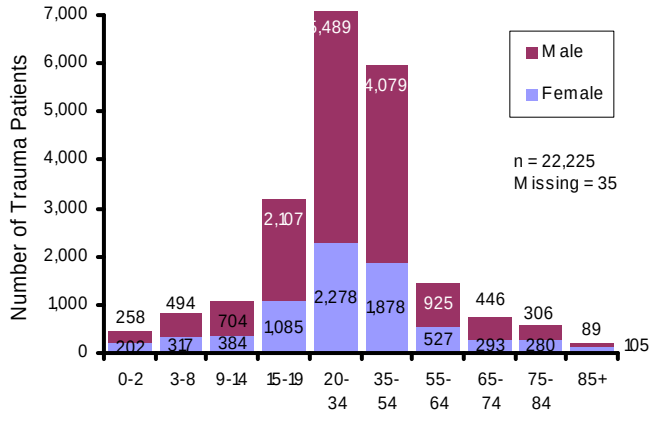
Figure 2: Adult and Pediatric Trauma Volume



Gender

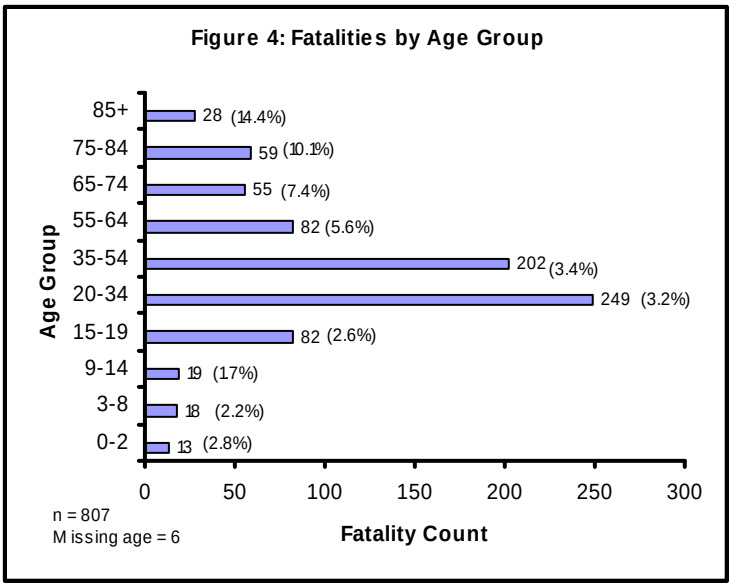
Males represent a greater share of the trauma volume than do females (Figure 3). Sixty-seven percent of all trauma patients were male and 33% were female. The proportion of males is higher than females in all age groups from birth to 84 years of age. However, in ages 85 and older, males and females represent almost an equal number of trauma cases.

Figure 3: Trauma Patients by Age and Gender



Fatalities by Age

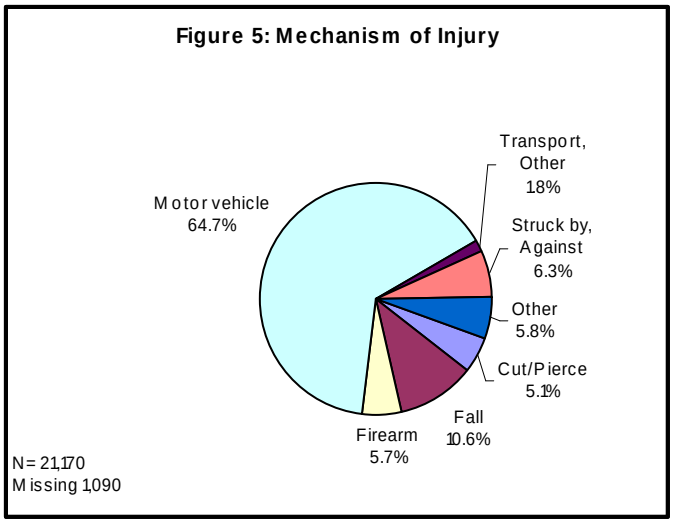
In 2005, 813 patients died of traumatic injury. This number does not include deaths occurring at the scene, during transport or deaths occurring soon after discharge from the hospital. The highest fatality rate was among patients aged 85 years and older (14.4%) (Figure 4).



Mechanism of Injury (MOI)

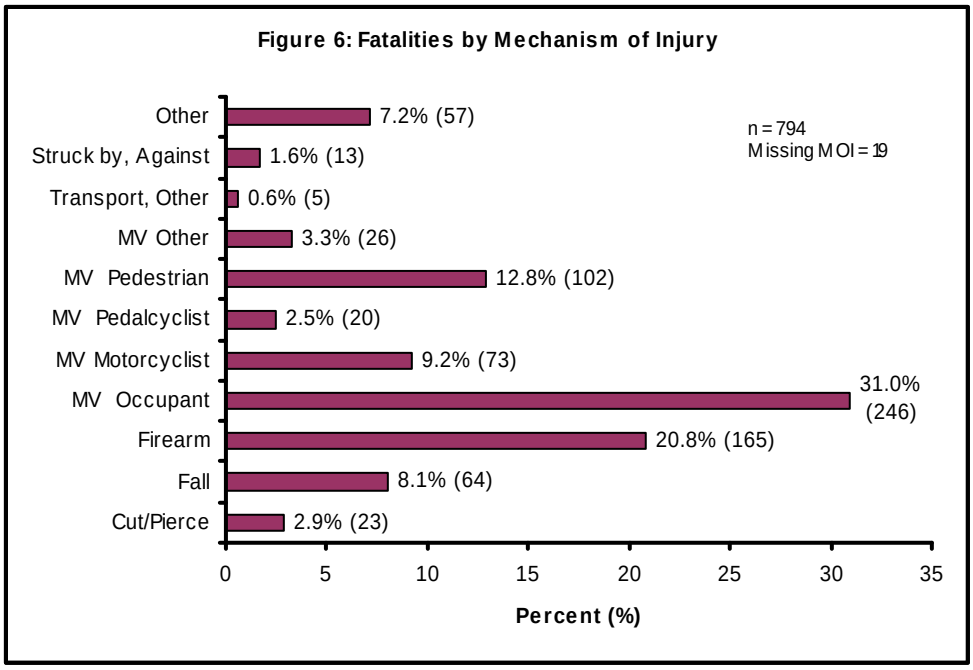
Motor vehicle crashes are the predominate mechanism of injury and represent 64.7% of all traumatic injuries reported (Figure 5). Falls are the second highest cause of injury representing 10.6% of cases.

Injuries resulting from being struck by or striking against objects or persons accounted for 6.3 % of cases and represents the third highest cause of injury. Firearm injuries represent the fifth and cut/ pierce represent the sixth highest cause of injury. (Transport, other includes railroad, water transport, animal-drawn transport, off-road vehicles etc.)



Fatalities by Mechanism of Injury

Of all trauma patients, 3.8% (813) of trauma patients died. Motor vehicle (MV) crashes accounted for the highest number of fatalities (58.8%) with MV Occupant 31.0%, MV Pedestrian 12.8%, MV Motorcyclist 9.2%, MV Pedal-cyclist 2.5%, and MV other 3.3% (Figure 6). After motor vehicle crashes, firearm related deaths accounted for the second highest cause of fatalities (20.8%) and falls accounted for the third highest cause of fatalities (8.1%).



Types of Injury

Trauma injuries were further classified as Unintentional and Intentional injuries; and based on the gross mechanism as Blunt and Penetrating injuries.

Unintentional Injuries

Eighty percent of traumatic patients incurred their injuries by unintentional means (Figure 7). Motor vehicle crashes were the most significant cause of unintentional injuries, followed by falls. The most lethal mechanism was pedestrians struck by motor vehicles with a fatality rate of 10.2%, followed by pedal-cyclists struck by motor vehicles with a fatality rate of 6.1% (Table 4).

Figure 7: Causes of Unintentional Injury

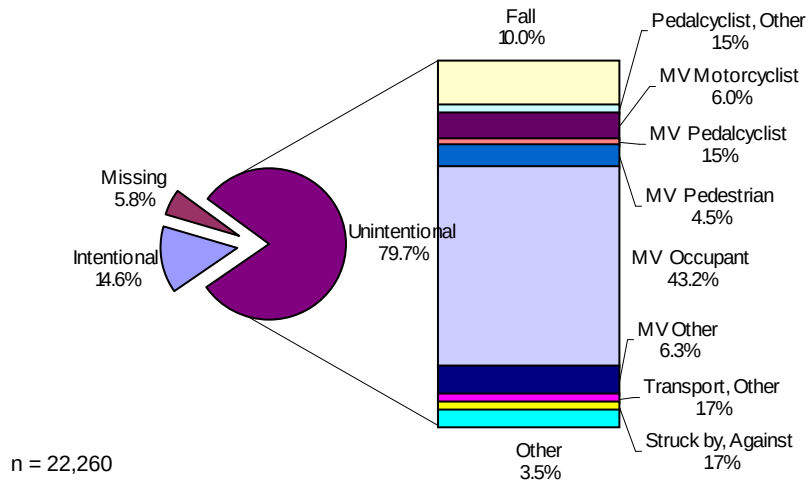


Table 4: Unintentional Injuries and Fatalities

Unintentional Injuries	Number of Patients	Number of Deaths (%)
Fall	2,216	62 (2.8%)
Pedalcyclist, Other	327	6 (1.8%)
MV Motorcyclist	1,328	73 (5.5%)
MV Pedalcyclist	326	20 (6.1%)
MV Pedestrian	1,000	102 (10.2%)
MV Occupant	9,615	246 (2.6%)
MV Other	1,393	25 (1.8%)
Transport, Other	374	5 (1.3%)
Struck by, Against	381	3 (0.8%)
Other	772	24 (3.1%)
Total Unintentional Injuries	17,732	566 (3.2%)

Intentional Injuries

Fifteen percent of traumatic patients incurred their injuries intentionally (Figure 8). The most common and the most lethal intentional injury was firearms (4.3% with a fatality rate of 14.7%) (Table 5).

Figure 8: Causes of Intentional Injury

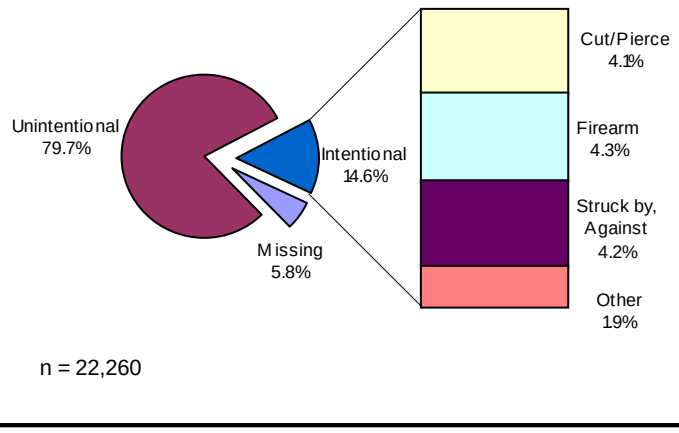


Table 5: Intentional Injuries and Fatalities

Intentional Injuries	Number of Patients	Number of Deaths (%)
Cut/Pierce	921	21 (2.3%)
Firearm	961	141 (14.7%)
Struck by, Against	944	10 (1.1%)
Other	421	28 (6.7%)
Total	3,247	200 (6.2%)

Blunt Injury

Approximately 84% of trauma cases were the result of blunt injury (Figure 9). Once again, motor vehicle crashes were a predominate mechanism of blunt injury, followed by falls. The most lethal mechanism of injury was pedestrians struck by motor vehicles, resulting in a 10.2% mortality rate (Table 6). The motor vehicle crashes accounted for the highest volume of deaths (246 deaths).

Figure 9: Cause of Blunt Injury

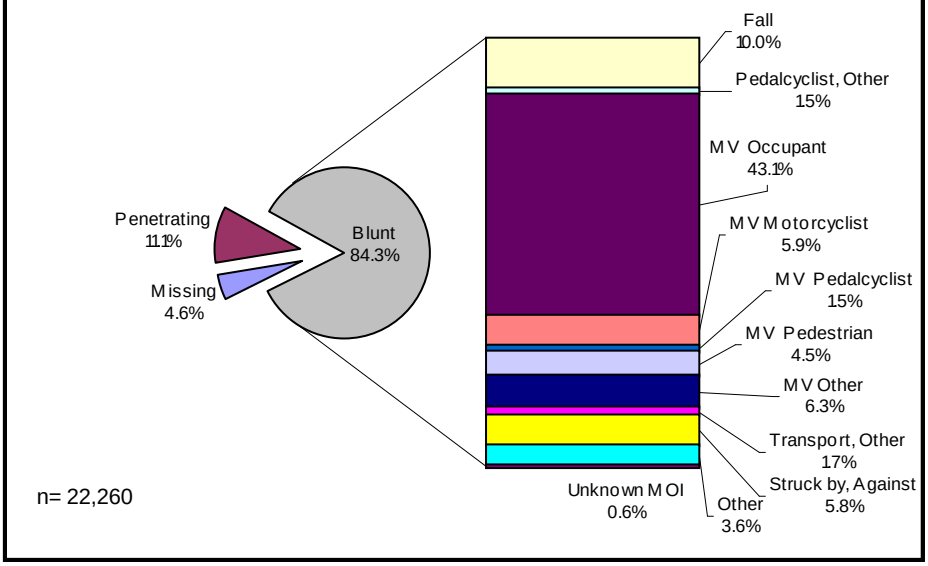


Table 6: Blunt Injuries and Fatalities

Blunt Injuries	Number of Patients	Number of Deaths (%)
Fall	2,217	64 (2.9%)
Pedalcyclist, Other	323	6 (1.9%)
MV Occupant	9,583	246 (2.6%)
MV Motorcyclist	1,323	73 (5.5%)
MV Pedalcyclist	325	20 (6.2%)
MV Pedestrian	996	102 (10.2%)
MV Other	1,406	26 (1.8%)
Transport, Other	369	5 (1.4%)
Struck by, Against	1,296	13 (1.0%)
Other	798	44 (5.5%)
Total	18,636	599 (3.2%)
Unknown MOI	130	

Penetrating Injury

Approximately 11.1% of trauma was the result of penetrating injury (Figure 10). The predominate mechanism of penetrating injury was due to firearm related injuries, followed by cut/pierce. The firearm injuries also resulted in the highest mortality rate of 13.9% (163 deaths) (Table 7). Overall, penetrating injuries were responsible for a total of 192 deaths.

Figure 10: Causes of Penetrating Injury

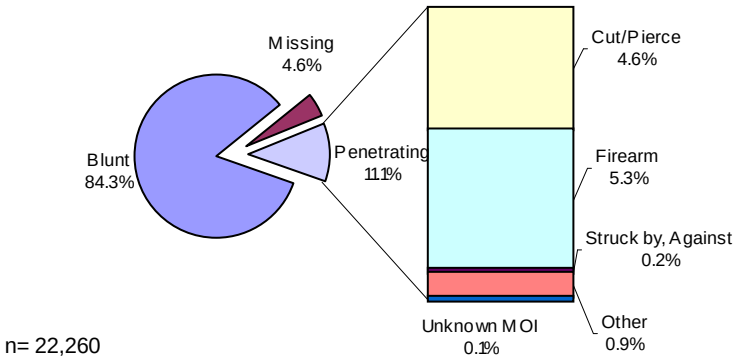


Table 7: Penetrating Injuries and Fatalities

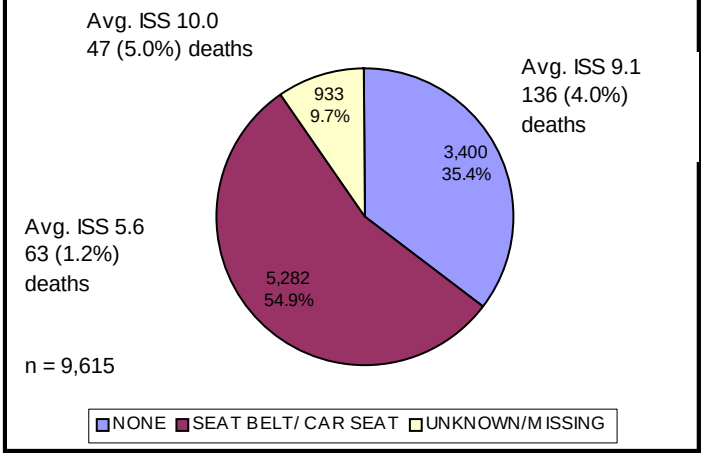
Penetrating Injuries	Number of Patients	Number of Deaths (%)
Cut/Pierce	1,028	22 (2.1%)
Firearm	1,170	163 (13.9%)
Struck by, Against	38	0
Other	203	7 (3.4%)
Total	2,439	192 (7.9%)
Unknown MOI	25	

Protective Devices Used in Motor Vehicle Crash, Motorcycle Crash, and Bicycle Crash

Restraint Use in Motor Vehicle Crash

Approximately 35% of patients were reported as using no restraint device when the motor vehicle they were driving or riding in crashed (Figure 11). The average Injury Severity Score (ISS) was lower for those who utilized a restraint device (ISS 5.6) as compared to those who did not use any device (ISS 9.1). The incidence of death was also lower for those who utilized a restraint device (1.2%) as compared to those who did not use any device (4.0%).

Figure 11: Restraint Use in Motor Vehicle Crashes (Occupant)



Helmet use in Motorcycle Crash

A total of 1,328 motorcyclists were admitted to a reporting hospital due to a crash (Figure 12). Forty-eight percent (637) of these motorcyclists did not wear a helmet. While the average ISS was not that different for those who wore a helmet (ISS 10.7) compared to those who did not (ISS 11.9), the mortality rate was higher in the non-helmet population (7.1% vs. 4.1%).

Helmet Use in Bicycle Crash

A total of 653 bicyclists were admitted to a reporting hospital due to a crash (Figure 13). More than half of these patients did not wear helmets (50.7%). While the average ISS did not differ between the helmeted (ISS 8.7) and non-helmeted group (ISS 9.6), the mortality rate was three times higher in the non-helmeted group (4.5% vs. 1.5%).

Figure 12: Helmet Use in Motorcycle Crashes

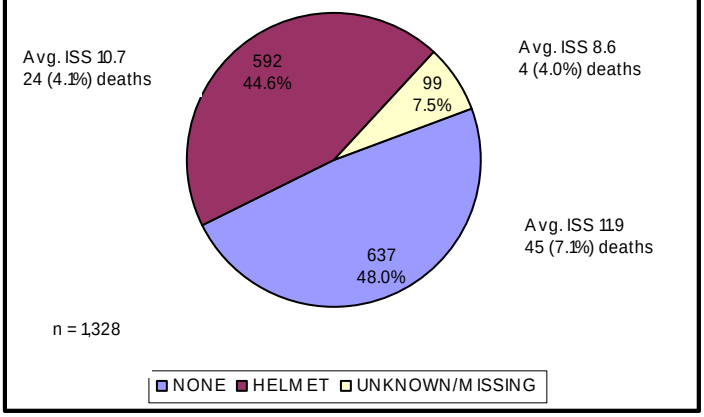
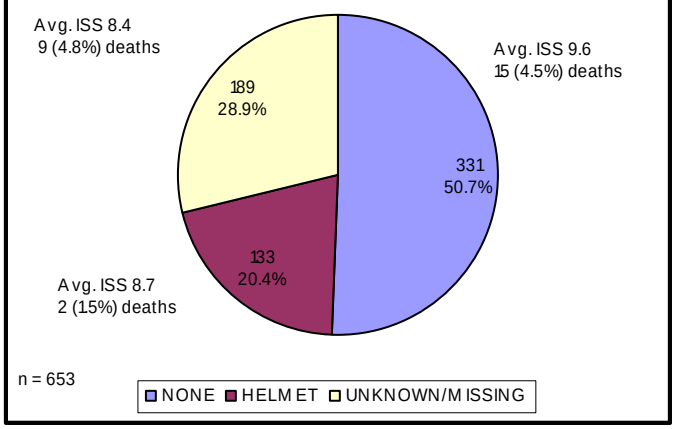


Figure 13: Helmet Use in Bicycle Crashes



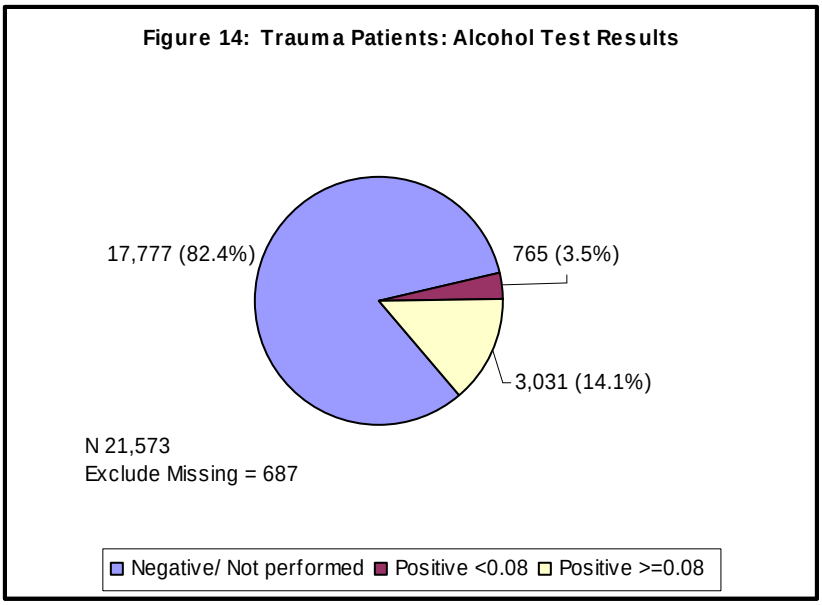
Trauma Patients: Alcohol and Drug Test Results

Alcohol Test Results

Of the 21,573 patients treated in reporting hospitals, 3,796 (17.6%) patients tested positive for blood alcohol test: 3.5% had an alcohol level of <0.08 gm/100cc and 14.1% tested positive at a level above the legal limit of 0.08 gm/100cc (Figure 14).

(The percent of patients with negative test result or test not performed are combined as the trauma registry does not have the capacity to separate them at this point).

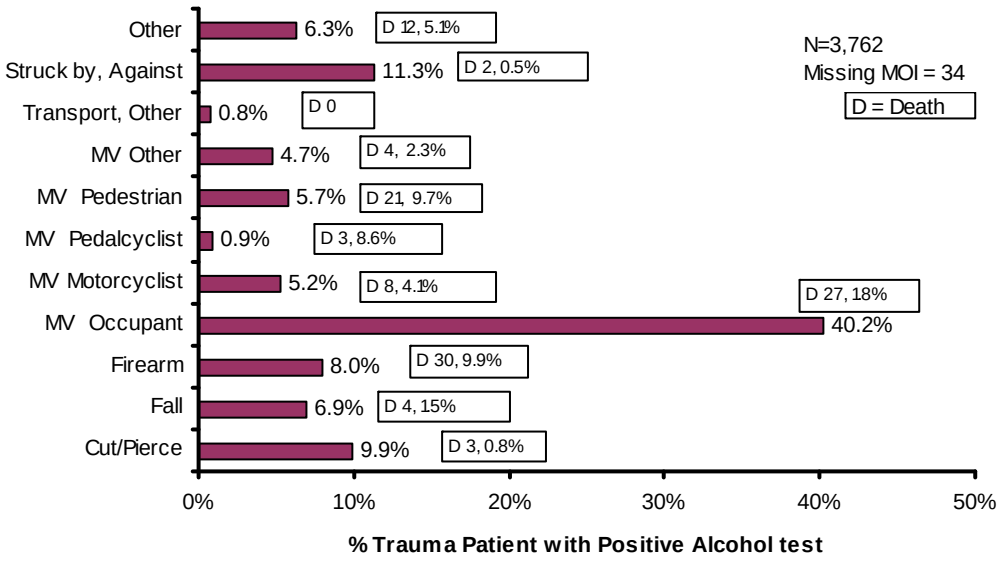
Figure 14: Trauma Patients: Alcohol Test Results



Mechanism of Injury among Trauma Patients with a Positive Alcohol Test

Among the patients who tested positive for alcohol, motor vehicle crash was the main cause of injury (40.2%) followed by struck by or against (11.3%) (Figure 15). Deaths are indicated for each mechanism of injury. The most lethal mechanism of injury associated with a positive alcohol test was firearm related injuries (9.9% mortality), followed by pedestrian struck by a motor vehicle (9.7%).

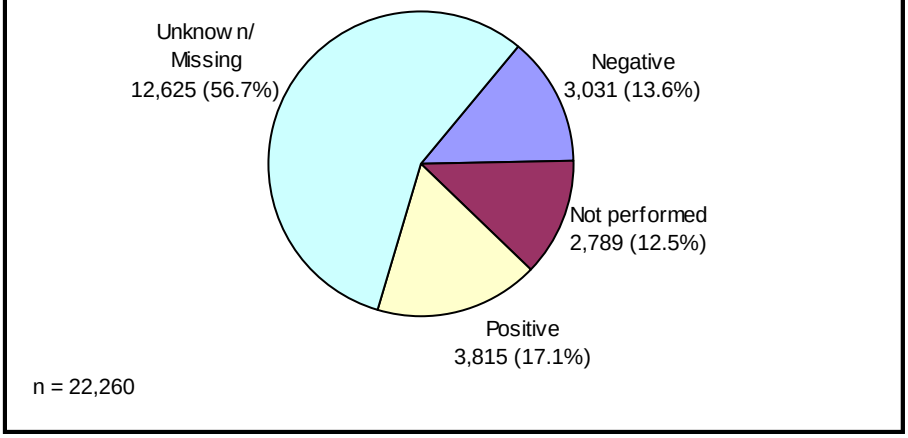
Figure 15: Mechanism of Injury among Trauma Patients with Positive Alcohol Test



Drug Screening Test Results

Of the 22,260 injured patients treated in reporting hospitals, 3,815 (17.1%) tested positive for drugs (Figure 16). This percent may be underestimated as the trauma registry has missing or unknown information for drug tests for more than half of the trauma patients.

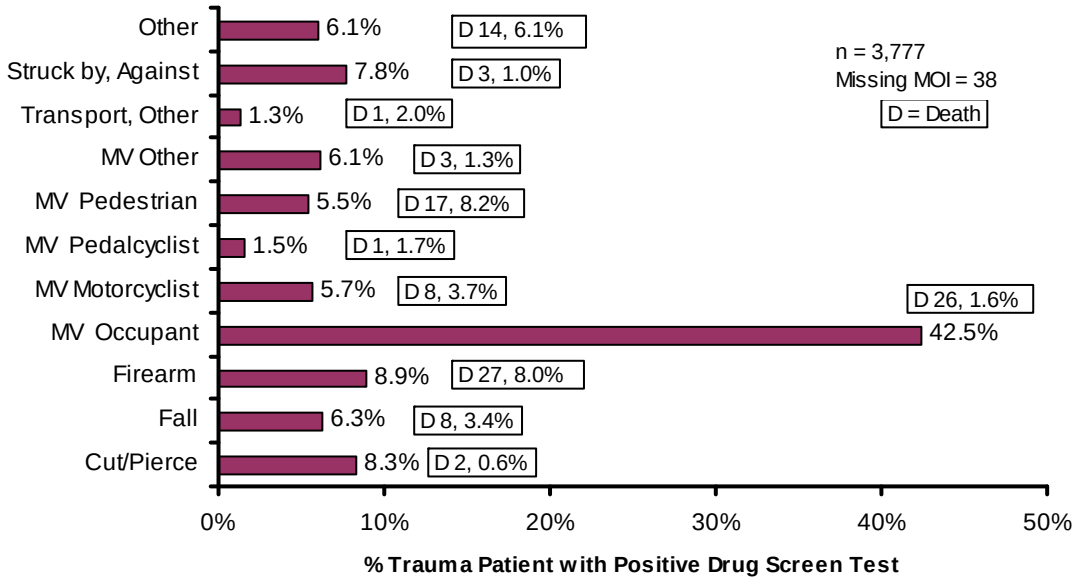
Figure 16: Trauma patient: Drug Screen Test Results



Mechanism of Injury among Trauma Patients with a Positive Drug Screen Test

Among the patients tested positive for a drug screen, motor vehicle crash was the predominate mechanism of injury (42.5%) followed by firearm related injuries (8.9%), and cut/pierce (8.3%) (Figure 17). The number of deaths are indicated for each mechanism of injury. The most lethal mechanism of injury is pedestrian struck by motor vehicle resulting in 8.2% mortality rate, followed by firearm injuries with a mortality rate of 8.0%.

Figure 17: Positive Drug Screen Result by Mechanism of Injury

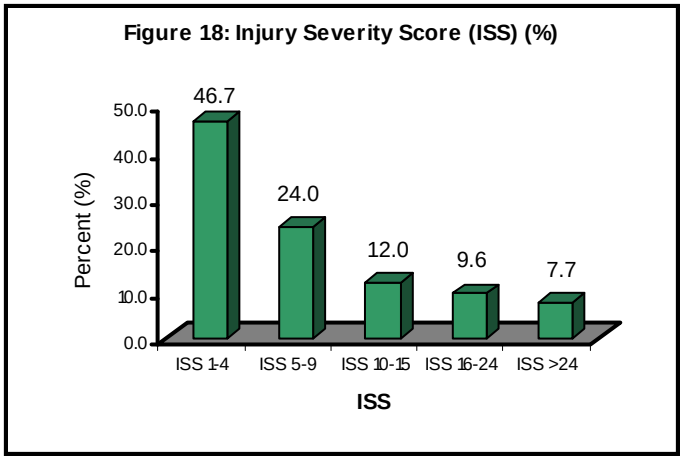


Injury Severity Score (ISS)

The Injury Severity Score (ISS) is a numerical value from 1 to 75 indicating the severity of an injury. The higher the number, the more severe the overall injuries. Each trauma patient is assigned a score based on the sum of squares of the Abbreviated Injury Scale (AIS) scores of the three most severely injured body regions.

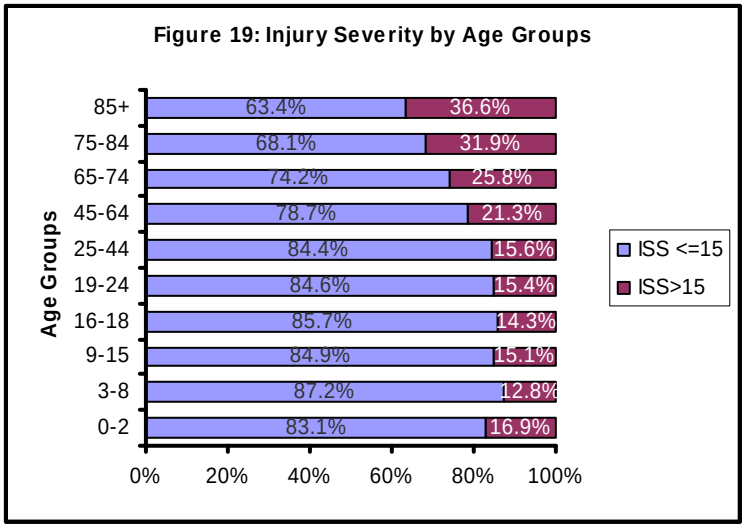
Injury Severity Score

Most of the trauma patients receiving care at the reporting hospital had an ISS between 1 and 4 (46.7%, n=10,400) (Figure 18). Seventeen percent of the patients (3,851) had severe injuries with an ISS > 15.



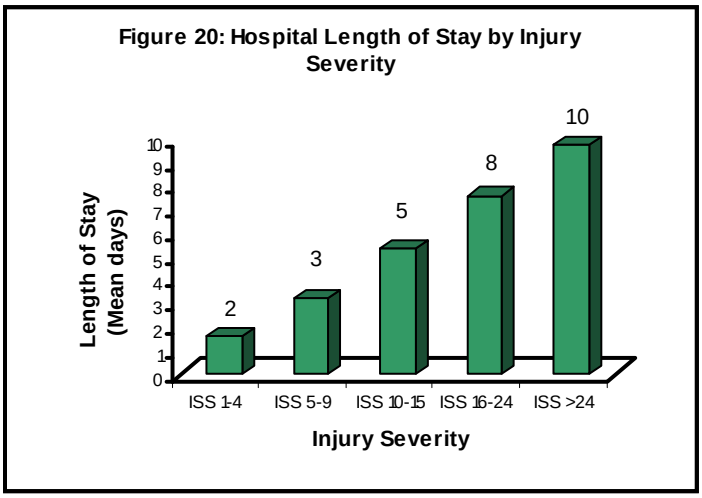
Injury Severity by Age

Trauma patients were considered seriously injured if they present with injuries characterized by an Injury Severity Score (ISS) greater than 15 and less severely injured if they present with an ISS score less than or equal to 15. The incidence of seriously injured patients increases with age (Figure 19). A very high percent of elderly patients aged 85 years and above (36.6%) presented with an ISS of >15 compared to any other age group.



Hospital Length of Stay by Injury Severity

The mean length of stay in the hospital increases as the ISS increases (Figure 20).

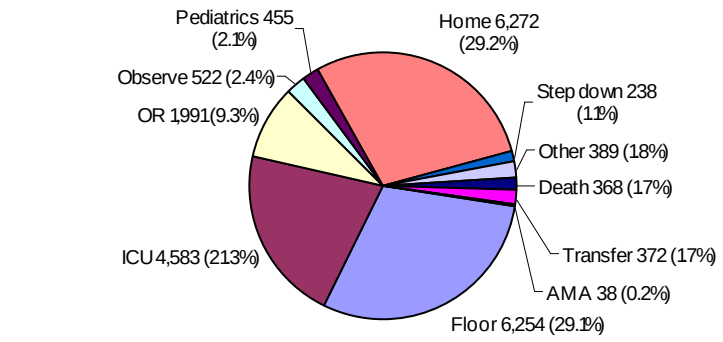


Discharge Disposition

ED Discharge Disposition

For the patients discharged from the emergency department (ED) (Figure 21), 21.3% of patients required treatment in an intensive care unit (ICU), and 29.1% were taken to standard hospital rooms for additional care. Patients discharged home from the ED accounted for 29.2%. Dead on arrival or expired patients accounted for 1.7%.

Figure 21: ED Discharge Disposition

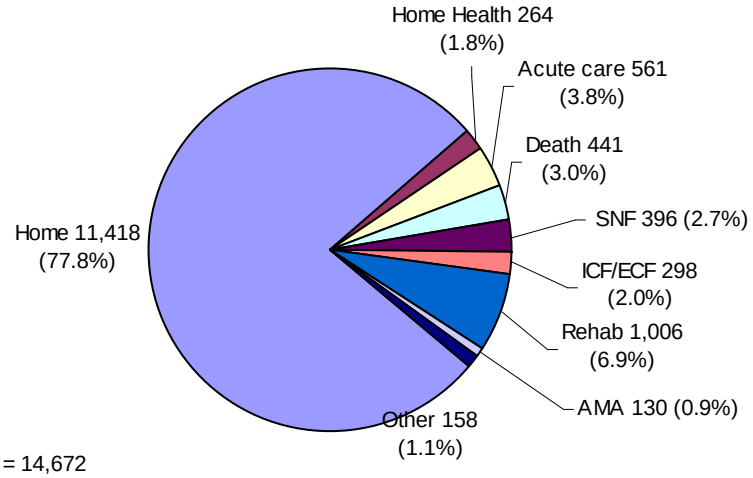


n = 21,482
Missing = 778

Hospital Discharge Disposition

Of the patients that were admitted to the hospital, 77.8% were discharged home. There were 1.8% requiring home health services (Figure 22). Approximately 7% of patients were discharged to a rehabilitation center, while 2.7% required additional care in a skilled nursing facility (SNF).

Figure 22: Hospital Discharge Disposition



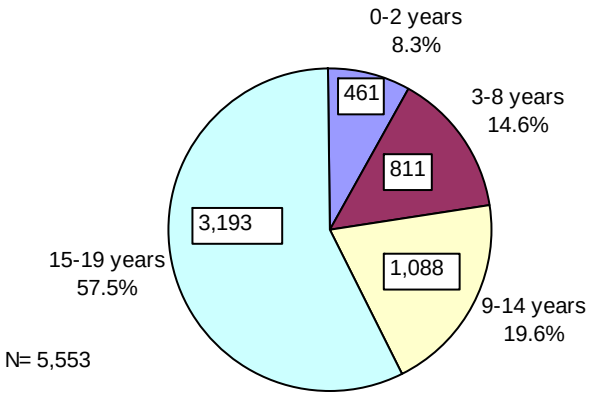
n = 14,672

Pediatric Trauma

Pediatric Trauma Patients by Age

In the year 2005, a total of 5,553 pediatric trauma patients aged 0-19 years were admitted to reporting hospitals across the state (Figure 23). Most of these patients (57.5%) were between age 15-19 years. Just over eight percent of these patients were age 2 years or younger.

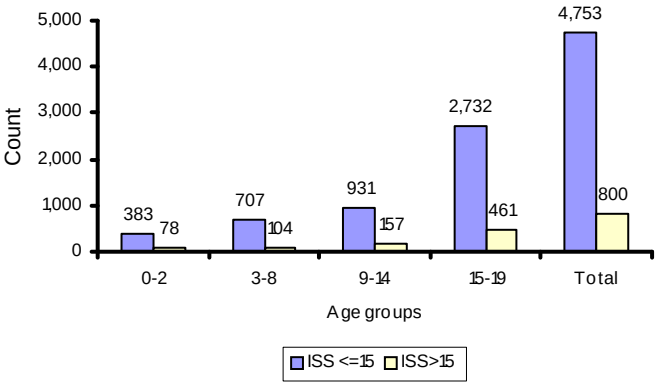
Figure 23: Pediatric Trauma Patients by Age



Pediatric Trauma Patient: Injury Severity

Eight-hundred pediatric patients (14.4%) presented with a serious injury, ISS >15 (Figure 24). The incidence of serious injury increases with age. The incidence of serious injury is highest among young people in the driving ages of 15-19 years.

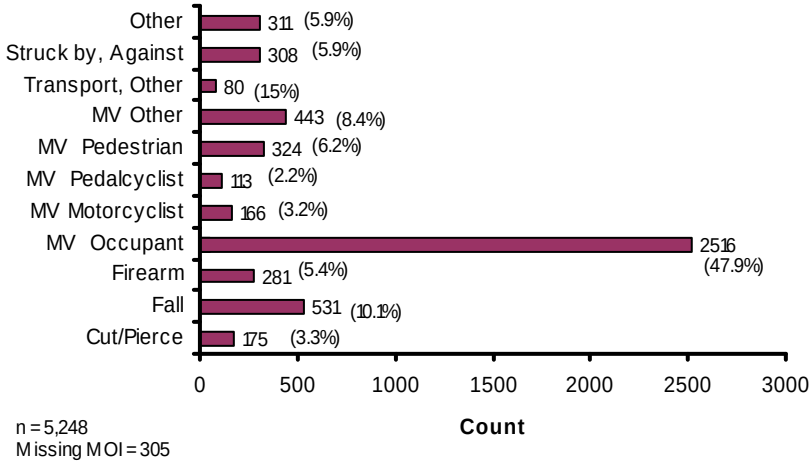
Figure 24: Injury Severity by Age Group



Pediatric Trauma Patient: Mechanism of Injury

Among the pediatric population, motor vehicle crashes were the predominate mechanism of injury (47.9%) followed by falls (10.1%) (Figure 25). However, for ages 15-19, firearms were the second leading cause of injury (8.0%).

Figure 25: Mechanism of Injury among Pediatric Trauma Patients

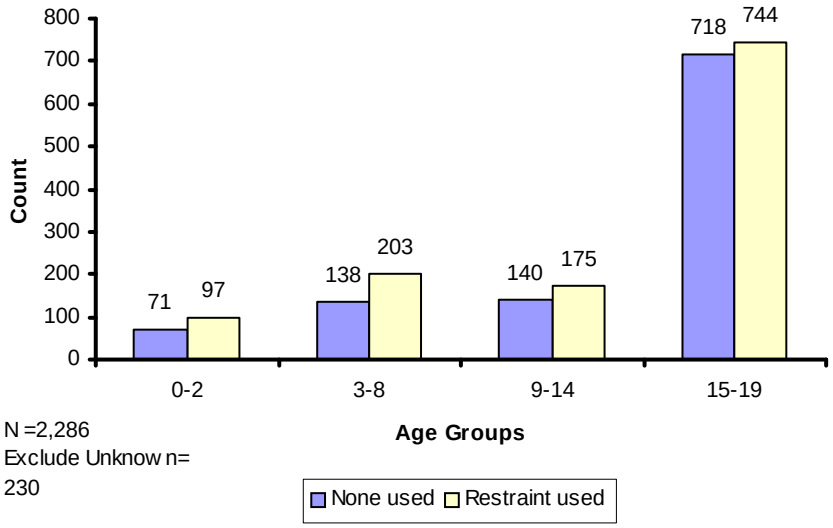


Restraint Use in Motor Vehicle Crash, Skateboard Injuries, and ATV Injuries

Motor Vehicle Crash

Overall, 46.7% of pediatric trauma patients were reported as using no restraint device (seatbelt or car seat) when the motor vehicle they were driving or riding in crashed. The highest non-restraint use was among pediatric trauma patients aged 15-19 years (49.1%), followed by patients aged 9-14 years (44.4%) (Figure 26). (This analysis includes MV occupant only cases).

Figure 26: Pediatric Safety Device Use in Motor Vehicle Crashes



Skate and Skateboard Injuries

Thirty-three pediatric trauma patients incurred skate or skateboard injuries (E codes 885.1-885.2) in the year 2005 (Figure 27). Only one patient was reported as wearing a helmet while using skates or a skateboard. Seventeen pediatric trauma patients (51.5%) were reported as wearing no helmet. The average ISS was higher for the non-helmeted population compared to helmeted (Avg. ISS 9.8 vs. 4.0).

All Terrain Vehicle (ATV) Injuries

Figure 28 reveals that 32% of pediatric patients were wearing helmets when the ATV (E code 821.0, 821.1, 821.8, 821.9) they were driving or riding on crashed and over half of the patients were not wearing helmets.

Figure 27: Helmet Use in Pediatric Trauma Patients with Skate and Skateboard Injuries

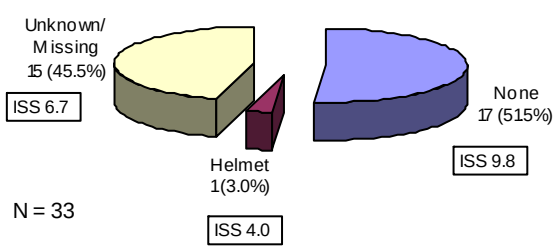
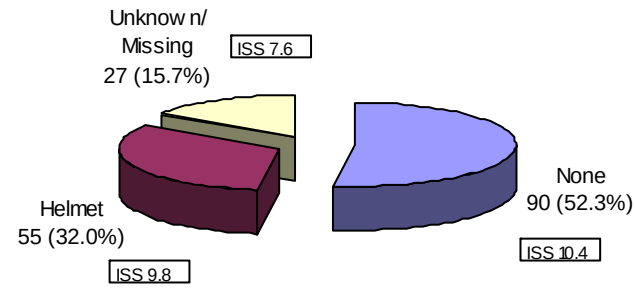


Figure 28: Helmet Use in Pediatric Trauma Patients with ATV Injuries



Pediatric Trauma Patients (Age 15-19 Years): Alcohol and Drug Test Results

Alcohol Blood Test Results

Of the 3,193 pediatric trauma patients (aged 15 to 19 years) treated in reporting hospitals across the state, 441 patients tested positive for a blood alcohol test: 3.8% had an alcohol level of <0.08 gm/100cc and 10.4% tested positive at a level above the legal limit of 0.08 gm/100cc (Figure 29). Among the pediatric patients testing positive for alcohol, motor vehicle crash (46.7%) was the predominate mechanism of injury, followed by cut/pierce (12.2%) and firearm injuries (11.5%) (Figure 30).

Figure 29: Alcohol Test Results of Pediatric Trauma Patients

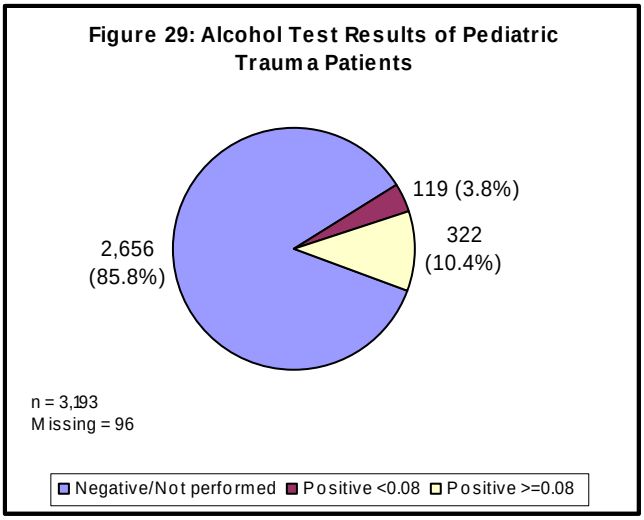
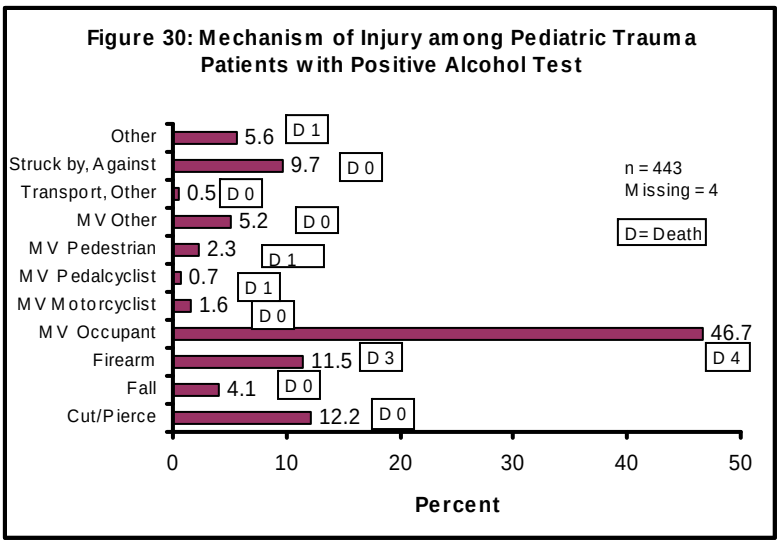


Figure 30: Mechanism of Injury among Pediatric Trauma Patients with Positive Alcohol Test



Drug Screen Test Results

Of the 3,193 pediatric trauma patients aged 15 to 19 years, 606 (19.0%) patients tested positive for drug screen test (Figure 31). Once again motor vehicle crash (47.2%) was the main mechanism of injury among the patients tested positive for drug followed by firearm injuries (12.1%) (Figure 32). Seven pediatric patients tested positive for drugs and died due to a motor vehicle crash and six patients died due to firearm injuries.

Figure 31: Drug Screen Test of pediatric Trauma Patients

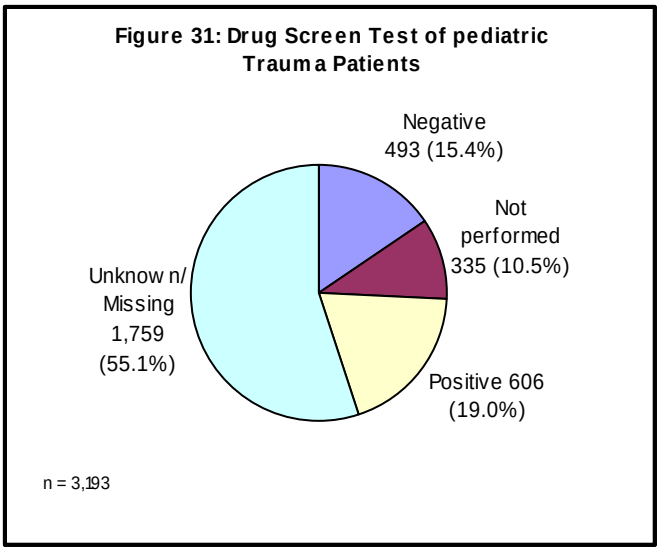
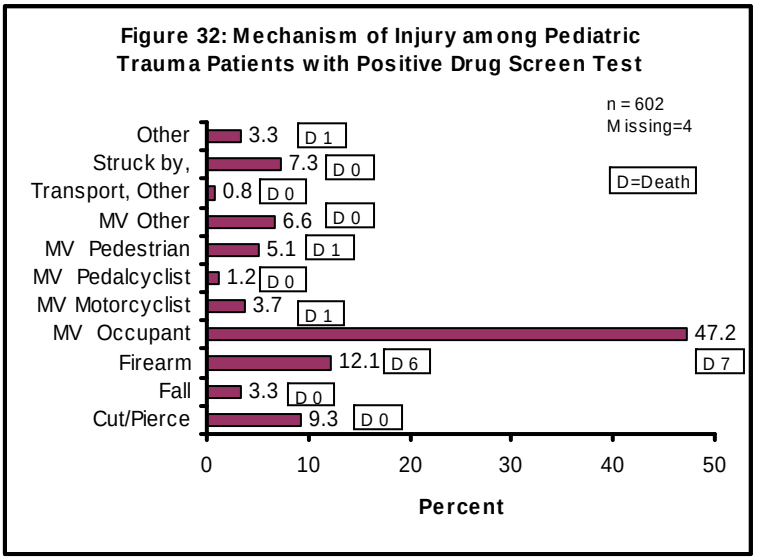


Figure 32: Mechanism of Injury among Pediatric Trauma Patients with Positive Drug Screen Test

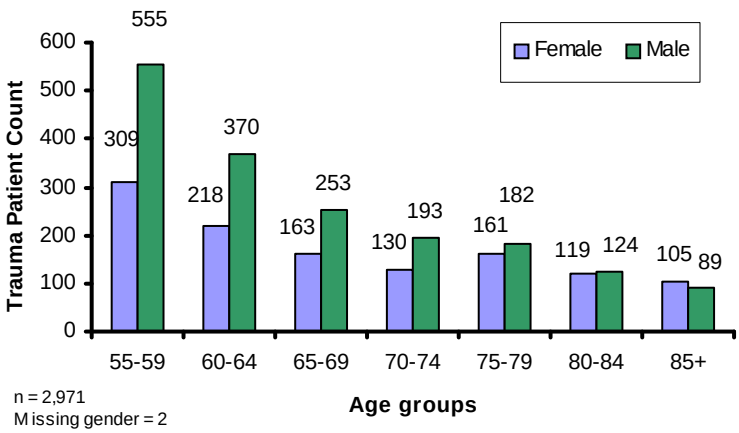


Geriatric Trauma

Geriatric Trauma by Age and Gender

Overall, 2,973 geriatric patients aged 55 years and older were admitted to reporting hospitals across the state in the year 2005. The proportion of males is higher than females in all age groups until age 74, then the proportion of trauma cases is almost equal among males and females (Figure 33).

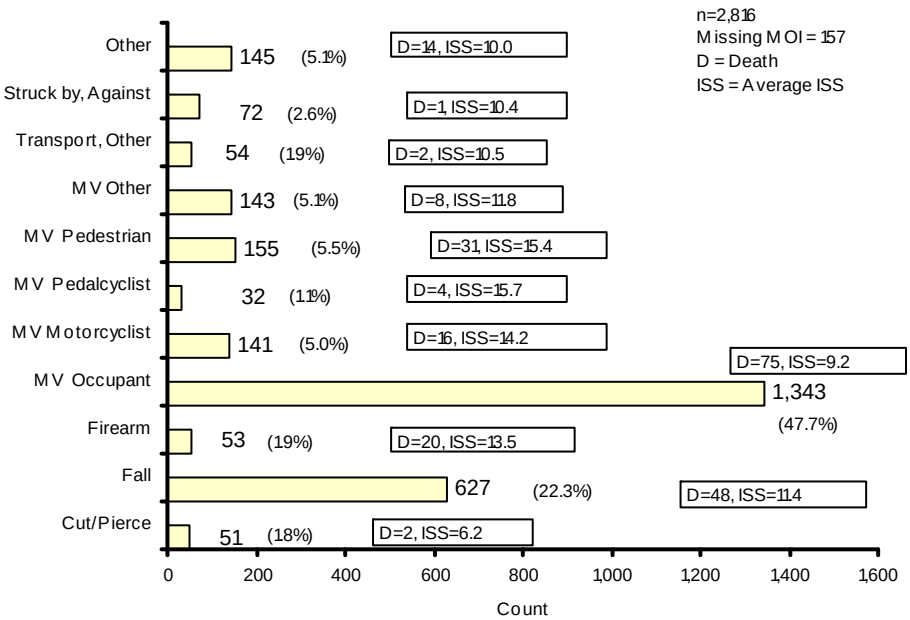
Figure 33: Geriatric Trauma by Age and Gender



Mechanism of Injury among Geriatric Trauma Patient

Once again motor vehicle crash was the predominate mechanism of injury among geriatric trauma patients. Almost half of the geriatric trauma patients (47.7%) incurred their injuries in a motor vehicle crash (Figure 34). Falls was the second highest mechanism of injury among geriatric trauma patients (22.3%). The most lethal injury was firearm injuries with a fatality rate of 37.7%.

Figure 34: Geriatric Trauma Mechanism of Injury



Geriatric Trauma Patients: Alcohol and Drug Test Results

Alcohol Blood Test Results

Of the 2,873 geriatric patients treated in the reporting hospitals across the state, 241 (8.4%) of the patients tested positive for blood alcohol: 2.2% had an alcohol level of <0.08 gm/100cc and 6.2% had an alcohol level above the legal limit of 0.08 gm/100cc (Figure 35). Among the geriatric patients who tested positive for alcohol, motor vehicle crash (28.8%) and falls (27.5%) were the predominate mechanisms of injury (Figure 36).

Figure 35: Alcohol Test Results of Geriatric Trauma Patients

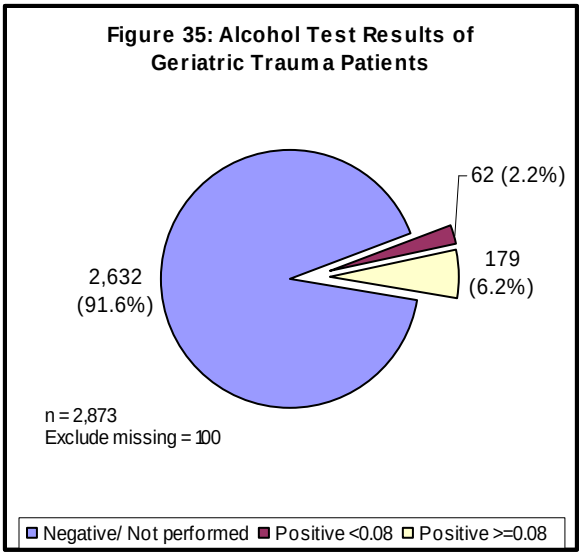
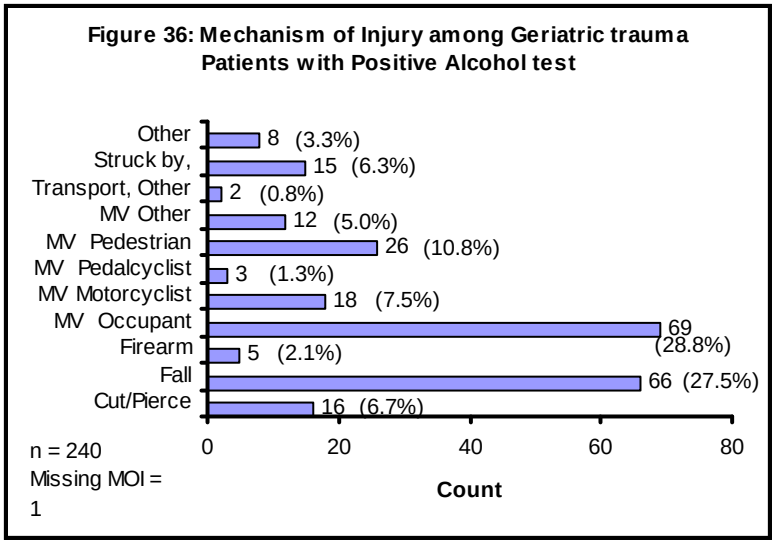


Figure 36: Mechanism of Injury among Geriatric trauma Patients with Positive Alcohol test



Drug Screen Test Results

Of the 2,973 geriatric trauma patients, 257 (8.6%) tested positive for drug screen test (Figure 37). Once again, motor vehicle crash (44.9%) was the predominate mechanism of injury followed by falls (20.9%) (Figure 38).

Figure 37: Drug Screen Test Results of Geriatric Trauma Patients

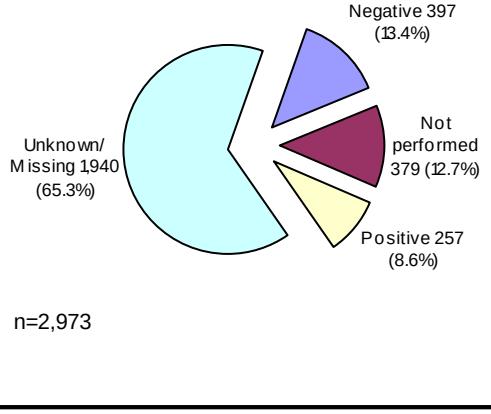
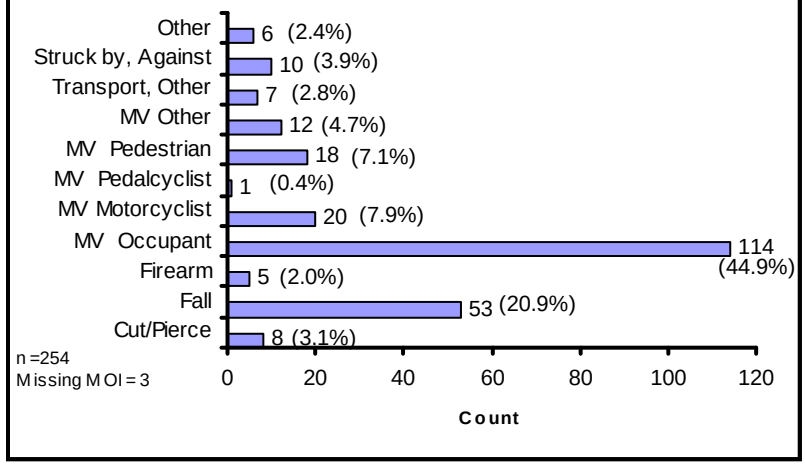
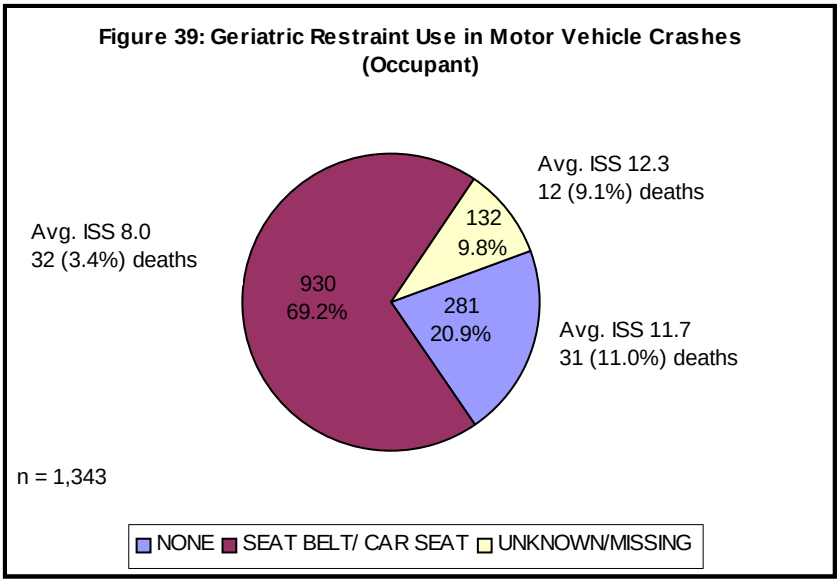


Figure 38: Mechanism of Injury among Geriatric Trauma Patients with Positive Drug Screen Test



Restraint Use in Motor Vehicle Crash

Sixty-nine percent of the geriatric patients were using a restraint device (seat-belt) when the motor vehicle they were driving or riding in crashed (Figure 39) . The average Injury Severity Score (ISS) was lower for those who utilized a restraint device (ISS 8.0) as compared to those who did not use any device (ISS 11.7). The incidence of death was also lower for those who utilized a restraint device (3.4%) as compared to those who did not use any device (11.0%).



Mortality among Geriatric Trauma Patients

Of 2,973 geriatric trauma patients, 224 (7.5%) patients died due to trauma. The highest fatality rate was among patients aged 85 + years (14.4%, n = 28) (Figure 40).